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Immediate Water Pollution Control Needs, Texas Coastal Waters

Federal Water Pollution Control Administration, Dallas, Tex

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IMMEDIATE WATER POLLUTION CONTROL NEEDS

TEXAS COASTAL WATERS

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
DALLAS, TEXAS 75202

APRIL 1967

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16. ABSTRACT

The purpose of the report is to focus attention on known sources of water pollution in this area and to provide a priority for action to correct existing problems and to prevent future problems.

17. KEY WORDS AND DOCUMENT ANALYSIS

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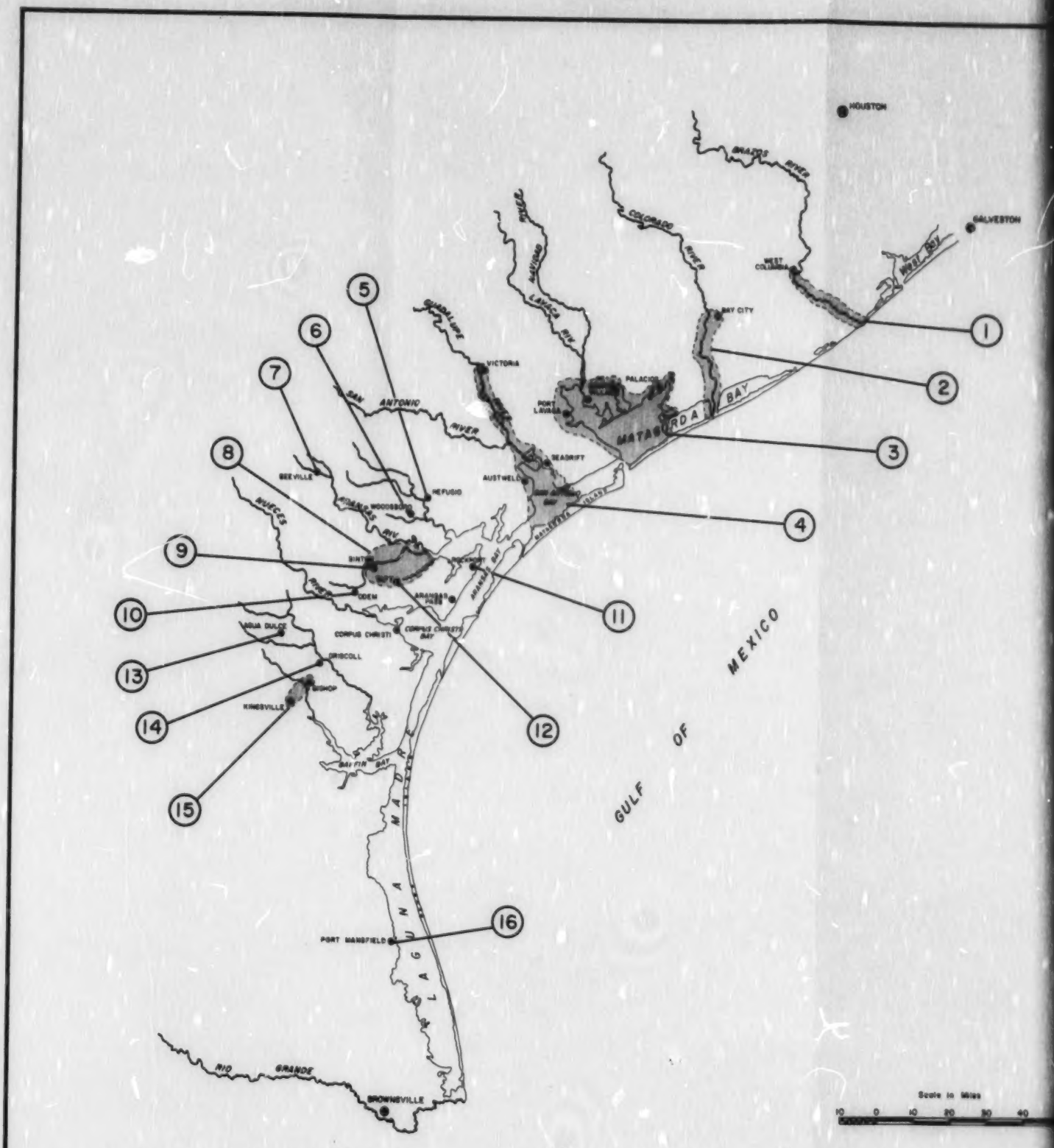
I. Introduction

The purpose of this report is to focus attention on known sources of pollution and to provide a priority for action to correct the existing water pollution problems and prevent future problems in the Texas coastal waters. This report is based on compilations of available data of the Federal Water Pollution Control Administration, South Central Region, the Texas Water Pollution Control Board, and other agencies of the State of Texas. No detailed water quality surveys or engineering studies were carried out for the preparation of this report.

The findings of this report are based on the best information available at this time on water quality conditions and immediate and potential pollution abatement needs. The omission of any particular town, industry, or other establishment from this report does not imply that an immediate or potential pollution abatement need does not exist in that particular area. Priorities listed are based solely on an evaluation of the Texas coastal waters and not on a relative basis with other basins in the South Central Region.

Authority is given in Section 3(a) of the Federal Water Pollution Control Act, as amended, for the preparation or development of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary conditions of surface and underground waters. This report by describing the immediate needs for controlling water pollution in the Texas coastal waters represents the first step in the development of a comprehensive program to control water pollution in these waters.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GALVESTON
WEST COLUMBIA
BAY CITY
MATAGORDA BAY
VICTORIA
GUADALUPE
LAVACA RIV.
PORT LAVACA
SEADRIFT
AUSTWELL
REFUGIO
BEEVILLE
WOODSBORO
SAN ANTONIO RIVER
NUECES RIV.
SINTON
ARANSAS PASS
ARANSAS BAY
CORPUS CHRISTI
CORPUS CHRISTI BAY
AGUA DULCE
DRISCOLL
KINGSVILLE
BAY FIN BAY
LAGUNA MADRE
PORT MANSFIELD
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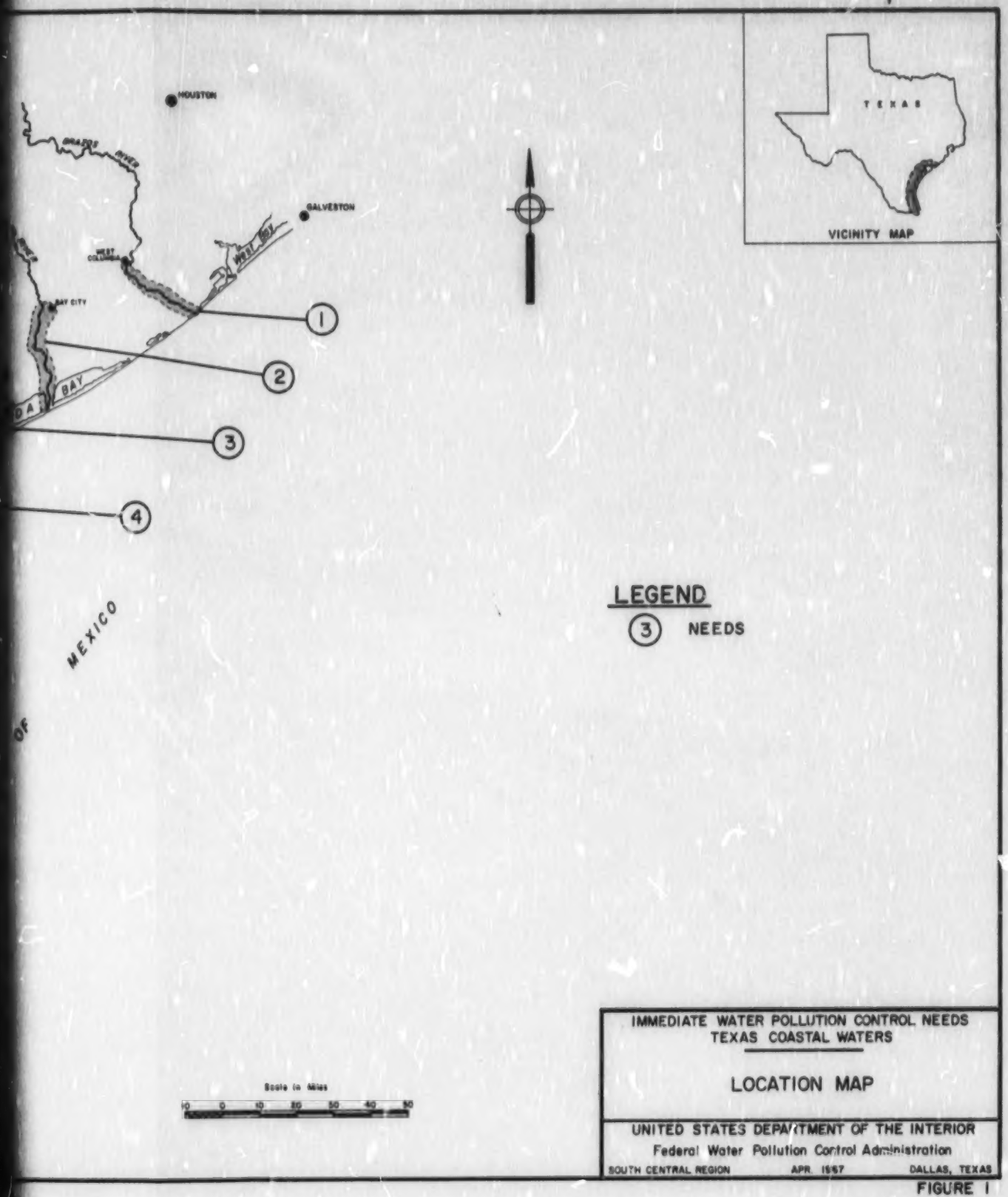

IMMEDIATE WATER POLLUTION CONTROL NEEDS
TEXAS COASTAL WATERS

LOCATION MAP

UNITED STATES DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration
SOUTH CENTRAL REGION APR. 1967 DALLAS, TEXAS

FIGURE 1

II. Summary

The water quality of the six areas considered in this report is generally good. Immediate pollution control needs must be considered in the sense of the prevention of future water quality deterioration damaging propagation of fish, other aquatic life, and recreation uses, rather than for correction of existing problems as indicated by abnormal salinity, septic conditions, and degraded aesthetics. In this context, the actions needed in the near future are shown in the following table.

Location	Responsibility	Need	Priority
Waste Treatment			
Brazos River			
1	Local governmental agency or district	Construction of area-wide sewage collection system & sewage & industrial waste treatment plants	B
Colorado Bay			
2	City of Bay City	Expansion of sewage treatment facilities	B
	Corps of Engineers	Installation of subsurface drain field for lock office and housing; secondary treatment at West Lock	B
Matagorda Bay			
3	City of Port Lavaca	Expansion of sewage treatment facilities	B
	City of Palacios	Expansion of sewage treatment facilities	B
	Point Comfort Village	Expansion of sewage treatment facilities	B
	Jackson County Water Control & Improvement District No. 2	Expansion of sewage treatment facilities	B

Waste Treatment (Continued)

Location	Responsibility	Need	Priority
San Antonio Bay			
4	Refugio County Water Control & Improvement District No. 1	Expansion of sewage treatment facilities	B
	City of Victoria	Expansion of sewage treatment facilities	B
	City of Austwell	Construction of primary & secondary treatment facilities	B
	Union Carbide Chemicals Co. near Seadrift	Additional biological treatment	B
	National Starch Company near Seadrift	Additional biological treatment	B
	E. I. duPont de Nemours & Co. near Victoria	Cooling ponds or other cooling facilities	B
	Central Power & Light Co. near Victoria	Cooling ponds or other cooling facilities	B
Aransas Bay			
5	Town of Refugio	Expansion of sewage treatment facilities	B
6	Town of Woodsboro	Expansion of sewage treatment facilities	B
7	City of Beeville	Expansion of sewage treatment facilities	B
9	City of Sinton	Expansion of sewage treatment facilities	B
10	City of Odem	Expansion of sewage treatment facilities	B

Waste Treatment (Continued)

Location	Responsibility	Need	Priority
11	City of Rockport	Expansion of sewage treatment facilities	B
12	City of Taft	Expansion of sewage treatment facilities	B
Laguna Madre			
13	City of Aqua Dulce	Expansion of sewage treatment facilities	B
14	City of Driscoll	Construction of primary & secondary treatment facilities	B
15	Celanese Chemical Co. near Bishop	Ponding of Cooling Water	B
	City of Bishop	Expansion of sewage treatment facilities	B
	City of Kingsville	Expansion of sewage treatment facilities	B
16	U.S. Coast Guard, Port Mansfield	Improvement of waste disposal system	B
Other Control Practices			
8	Various oil companies (Aransas Bay area)	More complete control of oil-field brines & other wastes (lined ponds, injection, etc.)	A
Institutional Practices			
Coastal Waters	State of Texas	Adopt use designations for the various areas of the Texas coastal waters in order to clarify water quality requirements for these areas.	B
Coastal Waters	State of Texas	Adopt water quality standards for the coastal waters of Texas	B

Institutional Practices (Continued)

Location	Responsibility	Need	Priority
Coastal Waters	State of Texas	Provide additional personnel for surveillance of the water quality of the various areas of the Texas coastal waters and of the various discharges to these areas, including operation of pollution control measures	A
Research			
Coastal Waters	State of Texas	Institute a complete compilation of all data obtained from previous general and specific studies of the various areas of the Texas coastal waters and carry out a complete study of the various areas of the Texas coastal waters in order to fully delineate the various factors affecting the quality of the waters of these areas that have not been completely evaluated in previous studies	B
Coastal Waters	FWPCA, State and local water pollution control agencies, institutions of higher learning, etc.	Initiate research, coordinated by Federal Water Pollution Control Administration on the control of salinity and nutrient buildup in shallow bay systems	B

III. Immediate Water Pollution Control Needs

Immediate pollution control needs in the Texas estuarine areas covered by this report must be interpreted in the sense of preventing future water quality problems rather than in the sense of correcting existing pollution problems. If population and industrial growth in the area continues as expected, improvements in various existing waste treatment facilities will be needed in the near future to keep pace with the growth. The general needs of the individual areas are shown in the table in Chapter II and discussed below.

The list of needs is not considered all inclusive. It does not reflect projected needs due to future obsolescence or to expanded or changed water uses. The actions recommended here are, however, prerequisite to good water quality planning and should be included in local, State, and Federal programming for water pollution control. Background for these immediate needs is summarized in Chapter VI.

Brazos River Estuary

The Brazos River estuarine area is one of the fast growing areas of the Texas Gulf Coast. Unless an area-wide collection system with central treatment plants is established, the rapid growth of the area could result in numerous small sewage and industrial waste treatment plants discharging effluents throughout the area. Such discharges could result in pollutional problems, particularly in localized areas. Based on these anticipated problems and the present rate of growth, it appears that an area-wide collection and treatment system for both municipal and industrial wastes will be needed in the near future.

Colorado River Estuary

When the Bay City barge canal is completed, the Colorado River estuarine area will experience some industrial expansion. Although the rate and location of the industrial expansion is difficult to predict at the present time, it will no doubt cause a population increase in the Bay City area resulting in the need for expansion of the Bay City sewage treatment facilities in the near future.

Matagorda Bay

Based on the assumption that the Matagorda Bay area will experience continued growth, it is estimated a number of the sewage treatment plants will need expansion in the near future. Expanded facilities will be needed for Port Lavaca, Palacios, Point Comfort Village, and the Jackson County Water Control and Improvement District No. 2.

San Antonio Bay

The completion of the Victoria barge canal will attract new industries to the San Antonio Bay area. Because these industries will probably be located along the barge canal with discharges to the canal, it is anticipated some refinements in the treatment facilities of the present industrial plants will be needed.

Population increases in the area will also result in the need for expansion of some of the sewage treatment facilities. The total needs and their timing cannot be accurately predicted at this time. However, based on the assumption that industrial and population expansion will come within a reasonable time, a number of treatment refinements and treatment plant expansions have been listed in the summary table, Chapter II.

Aransas Bay

A greater degree of control of oilfield brines and other oilfield wastes is the most pressing need in the Aransas Bay system. As the area's population and economy continue to grow, it can be expected that expanded sewage treatment facilities will be needed at Beeville, Odem, Refugio, Rockport, Sinton, Taft, and Woodsboro.

Laguna Madre

As the Laguna Madre area grows, it is anticipated that the treatment facilities of the cities will need improvement to care for that waste water that cannot be utilized in irrigation. It can be expected that expanded sewage treatment facilities will be needed at Aqua Dulce, Bishop, and Kingsville. The construction of primary and secondary waste treatment facilities will be needed at Driscoll.

Institutional Needs

The establishment of uses and water quality standards for the various areas of the Texas coastal waters requires official action by the State of Texas in the near future. The official designation of the uses and quality standards will aid materially in the present pollution control activities and the planning of future activities. It is understood that steps are underway by the State of Texas to take the suggested actions.

Pollution Surveillance

Surveillance of the water quality of the Texas coastal waters is presently carried out by agencies cooperating with the Texas Water Pollution Control Board (TWPCB). The principal agencies are the Texas Parks and Wildlife Department, the Texas State Department of Health, and the Texas Water Development Board. In addition, the

TWPCB receives copies of reports of special studies made by both public and private agencies.

There is an immediate need for the provision of a field staff for the TWPCB to carry out routine water pollution control surveillance of the estuarine areas, including operation of water pollution control measures, and to coordinate the activities of the other agencies. Under a proposed reorganization of the TWPCB, such a field staff will be provided. This staff would have the prime responsibility for surveillance with the other agencies continuing their survey activities within their particular authority and responsibilities. It is anticipated that the TWPCB surveillance would be the responsibility of a regional group covering most of the lower Gulf Coast of Texas.

Special Studies and Research

Two special studies are needed in the near future for each of the estuarine areas of Texas. The first is a comprehensive inventory and collation of existing data on the estuarine areas. This study would provide in one document the information needed for effective pollution control and would provide a basis for planning specific studies of each of the estuarine areas.

Following the collation of existing data, the study should continue with a complete investigation of each estuarine area. These investigations would fill in the gaps in the existing data and fully delineate the various factors governing the control of water quality in each estuarine area. Limited resurveys should be made from time to time to update the information and detect any changes in the governing factors.

Overall research into the problems of salinity and nutrient buildup in shallow bay systems is needed. This research, by Federal Water Pollution Control Administration, State, and local water pollution control agencies, institutions of higher learning, etc., should be coordinated by Federal Water Pollution Control Administration and directed toward the complete evaluation of the general parameters governing the buildups. The information obtained would be valuable in constructing mathematical models for specific bay areas of the Texas Gulf Coast as well as bays in other sections of the country.

IV. Costs

Estimated costs for improved treatment, additional surveillance, and special studies are summarized in Tables I and II.

Table I

Summary of Costs
Treatment Improvements and Additional Surveillance

Estuarine Area	Treatment Improvements	Additional Surveillance
Brazos River	$24,500,000	$ 30,000
Colorado River	362,000	30,000
Matagorda Bay	1,196,000	30,000
San Antonio Bay	1,610,000	30,000
Aransas Bay	3,980,000	30,000
Laguna Madre	1,033,000	30,000
TOTAL	$32,681,000	$180,000

Table II

Summary of Costs - Special Studies

Estuarine Area	Inventory & Collation	Complete Survey	Total
Brazos River	$ 15,000	$ 200,000	$ 215,000
Colorado River	10,000	100,000	110,000
Matagorda Bay	30,000	300,000	330,000
San Antonio Bay	30,000	300,000	330,000
Aransas Bay	30,000	300,000	330,000
Laguna Madre	30,000	300,000	330,000
TOTAL	$145,000	$1,500,000	$1,645,000

Research

No estimate of the overall cost of the suggested research has been made.

V. Recent Progress in Pollution Control

As the result of the various water pollution control measures cited below, the waters of the Texas coast are of generally good quality and usability.

The Texas Water Pollution Control Law (Article 7621(d), Vernon's Civil Statutes) was passed in 1961 and became fully effective in November 1962. This law requires permits for the discharge of any waste waters that may cause pollution. At present, administration of the law is carried out under a seven-man Water Pollution Control Board.

The law provides for the issuance of statutory permits to continue discharges existing at the time of its passage. After its initial effort to inventory all existing waste discharges, the major effort of the WPCB has been in three general activities. These have been control of pollution in the Galveston Bay area, control of oilfield brines throughout the State, and upgrading water quality of localized problem areas.

Formal actions by the TWPCB in the estuarine areas covered by this report have primarily involved actions on individual permits for new installations. An active program for securing voluntary improvements is being carried forward through efforts of the Texas State Department of Health, the Texas Parks and Wildlife Department, the Texas Railroad Commission, and the Texas Water Development Board. Various local governmental agencies cooperate in this effort.

The voluntary program, along with Federal grant funds, has resulted in the construction or expansion of at least 11 sewage treatment plants and 6 industrial waste treatment plants. This construction has resulted in maintaining a generally good water quality throughout the estuarine area during a period of both population and industrial expansion.

It is understood that the Texas Legislature has under consideration proposed bills to reorganize water pollution control activities in Texas. If this legislation is passed, the TWPCB will be strengthened and provided with a much expanded staff.

It is also understood that the Texas Railroad Commission has under consideration a statewide "no pit" order for the abatement of pollution resulting from petroleum extraction. An order of this nature would, in effect, eliminate the discharge of oilfield brine to the surface of the ground except where specific exceptions to the order are made.

Both of the above, as well as the adoption of water quality criteria, should materially strengthen pollution control activities in the coastal waters of Texas.

VI. Background for Recommendations

Pertinent Basin Characteristics

The coast of Texas extends 370 miles along the Gulf of Mexico from the Louisiana State line to the United States-Mexico border. This coastline, in the shape of a crescent spanning an arc of about 90°, consists of long narrow islands and peninsulas separating the mainland from the Gulf of Mexico. The ten major estuarine areas, spaced somewhat evenly along the coastline, are designated as follows:

1. Sabine Lake
2. Galveston Bay
3. Brazos River Estuary
4. Colorado River Estuary
5. Matagorda Bay
6. San Antonio Bay
7. Aransas Bay
8. Corpus Christi Bay
9. Laguna Madre
10. Rio Grande Estuary

Sabine Lake is discussed in the Sabine River report, the Rio Grande Estuary in the Rio Grande report, and Corpus Christi Bay and Galveston Bay in separate reports. The other six estuarine areas are the subject of this report.

Texas Coastal Characteristics

General

Only two of the major rivers in Texas, the Brazos and Colorado, discharge to the Gulf of Mexico. The other rivers discharge to shallow bays connected to the Gulf of Mexico by relatively narrow passes through the islands and peninsulas. In general, the bays are interconnected forming what might be termed a long narrow saline lake with a limited number of outlets to the Gulf of Mexico.

The Intracoastal Waterway extends the entire length of the Texas coast and has opened the various bays to barge traffic. In addition, various passes to the Gulf of Mexico have been deepened to allow the entrance of oceangoing vessels as well as the passage of the gulf fishing fleet which operates out of all the estuarine areas except the Colorado.

The three common characteristics of the estuarine areas of Texas are their shallow landlocked nature, their reduced fresh water inflow, and the relatively small tidal fluctuation. Each of these characteristics, discussed more completely below, presents special problems in the control of water quality of the estuarine areas. A summary of the characteristics of each estuarine area is provided in Table III.

Table III

Characteristics of Texas Coastal Waters

Estuarine Area	Location		Area	Depth-ft.		Average Annual Rainfall	Mean Temperature °F		
	Latitude	Longitude	Acres	Average	Maximum	in.	Winter	Summer	Annual
Brazos River	28°55'	95°20'		5-20	36	45.49	56	82	70
Colorado River	28°41'	95°59'		8	20	42.53	56	83	70
Matagorda Bay	28°30'	96°20'	233,000	10	14	37.75	57	83	70
San Antonio Bay	28°15'	96°43'	138,000	5	7	33.75	58	83	71
Aransas Bay	28°05'	97°00'	127,000	7	11	27.42	59	84	72
Laguna Madre	27°38' to 26°05'	97°15'	317,000	1 to 3	2 to 7	27.42 to 25.80	59 to 63	84 to 84	72 to 74

Estuarine Area and Depth

The Brazos and Colorado Rivers discharge by way of a tidal plain directly to the Gulf of Mexico. The remaining estuarine areas covered by this report consist of bay systems. These bays are interconnected behind barrier islands from Matagorda Bay on the north to the Rio Grande Estuary on the south. Each titled bay system is made up of a number of smaller bays and coastal indentations.

The maximum depth for the bays along the Texas Gulf Coast is 15 feet. Most of the bays have an average depth of 8 feet with large areas of shallower water. Channels up to 40 feet in depth have been cut through several of the bays.

Fresh Water Inflow

Flood control, power, or water supply reservoirs have been constructed on all the major streams of Texas. Preliminary planning calls for reservoirs on the few remaining smaller streams as well as additional reservoirs on the major streams. The net result of the existing reservoirs has been the overall reduction of the fresh water inflow from local rainfalls.

An example is the Colorado River basin. This basin has 9 reservoirs on the main stem, and 8 reservoirs on tributaries at the present time. The river is controlled near Austin on the basis of downstream water use. This control takes into full consideration any downstream rainfall and tributary flow. At times during irrigation season along the coast, very little, if any, fresh water reaches the Colorado River estuary. Additional reservoirs are in the planning stage for both the main stem and tributaries in this basin.

Tidal and Wind Exchange

The normal tidal fluctuation along the Texas Gulf Coast does not exceed two feet. At times of prolonged strong winds there is no apparent tidal change in the interior of the bays. With strong winds from an inland direction, large areas of the bay floor near shore will remain dry throughout a tidal cycle.

The combination of the slight tidal fluctuations, the reduced fresh water inflow, and the narrow connections to the Gulf of Mexico restricts the exchange of bay water with Gulf of Mexico water. These bays do not receive the continual or periodic flushing normally associated with estuaries. There is flushing during localized heavy rainstorms, hurricanes, and in some cases with prolonged strong winds. However, flushings of this nature are erratic and often with long elapses of time between flushings.

Area Development

General

Agricultural, industrial, and recreational activities are intermingled throughout the length of the Texas Gulf Coast area. In general, farming and industrial operations are inland (bordering the bays) with ranching operations interspersed and extending to the Gulf of Mexico. Recreational areas are established along the shorelines of the bays and on the barrier islands.

Population and Industrial Density

The major portion of the population and industrial development is concentrated in four areas. These are the "Golden Triangle" consisting of Beaumont, Port Arthur, and Orange, the Galveston-Houston area, the Corpus Christi area, and the lower Rio Grande Valley. These areas are covered in other reports. Between these major centers of population and industry are a number of smaller cities and individual industrial plants. In general, the population and industrial density decreases uniformly from the Louisiana State line to the lower Rio Grande Valley. Laguna Madre on the lower Gulf Coast borders an unpopulated area with large ranches on the inland side and the undeveloped Padre Island National Seashore on the gulf side.

Recreational Development

Perhaps the best description of the recreational development is "When the shoreline is accessible, it is used for recreational purposes." All the bays have tourist, boat supply, and boating facilities. Charter boat service is available throughout the length of the coast. Most of the counties maintain fishing docks and formal swimming areas. However, any accessible beach is used for both fishing and swimming.

Commercial Fishing and Processing

Commercial fishing fleets operate out of all the estuarine areas with the exception of the Colorado estuary and the major portion of Laguna Madre. Docking and processing facilities are scattered along the entire coast at points where easy access to the Gulf of Mexico is available. The most dense development of this nature is between Corpus Christi and Galveston, and at Port Isabel on the south end of Laguna Madre. Commercial shellfish harvesting is carried out in all the bays except Laguna Madre.

Present Texas Estuarine Water Quality

The quality of the waters of the Texas estuarine areas covered by this report is considered to be good at the present time. Isolated quality problems that have existed from time to time in various bays appear to have been alleviated.

Water Uses

The waters of the Texas estuarine areas are used for recreation, commercial and recreational fishing, shellfish production, navigation, industrial cooling water, some industrial processing waters, and other legitimate uses. In general, the present water quality is adequate for these uses.

Water Quality Problems

There is no general overall water quality problem in the Texas estuarine areas at the present time. However, a long range potential problem of salinity increases, and nutrient buildup which will damage shellfish production and recreation use does exist in all the bays. Laguna Madre has historically experienced natural salinity buildups due to its size, shape, location, and lack of fresh water inflow. As the fresh water inflows to the other bays are reduced by upstream water developments, salinity and nutrient buildups are expected. The future extent and control of these buildups is now under study by several agencies, including the Texas Water Development Board and the Texas Parks and Wildlife Department.

Isolated water quality problems as indicated by low dissolved oxygen concentrations and degraded aesthetics have existed from time to time in individual bays. Although interference with propagation of fish and recreation use appears to have been alleviated at the present time, recurrence of these conditions is possible as the area continues to develop unless existing and new waste discharges are diligently controlled.

Brazos River Estuary

Downstream from West Columbia, Texas, the Brazos River and its estuarine area receives approximately 6.8 million gallons per day (mgd) of domestic wastes from 10 sewage treatment plants and approximately 30 mgd of industrial wastes, and 2,520 mgd of cooling water from 11 industrial plants. At the present time the domestic sewage receives both primary and secondary treatment while the industrial wastes are well controlled through various treatment methods and programmed discharges. Although there are no water quality problems at the present time, it is expected that due to the rapid growth in the area, an area-wide collection and treatment system for both municipal and industrial wastes will be needed in the near future to prevent water quality degradation with resulting interference with propagation of fish and recreation.

Colorado River Estuary

Downstream from Bay City, Texas, the Colorado River and its estuary receives approximately 1.0 mgd of domestic wastes from one

sewage treatment plant, and approximately 5.0 mgd of industrial wastes from five industrial plants. At the present time, the domestic sewage receives both primary and secondary treatment, and the industrial wastes are well controlled through various treatment methods. When the Bay City barge canal is completed, the area will experience some industrial and population expansion. It is expected that the Bay City sewage treatment plant will need to be expanded as the population in the area increases to prevent pollution of these waters.

Matagorda Bay

From its immediate area, Matagorda Bay receives approximately 2.6 mgd of domestic wastes from seven sewage treatment plants, and approximately 21.5 mgd of industrial wastes from 11 industrial plants. At the present time, the domestic wastes receive both primary and secondary treatment, and the industrial wastes are adequately controlled through various treatment methods and programmed releases.

San Antonio Bay

Downstream from Victoria, Texas, San Antonio Bay receives approximately 3.0 mgd of domestic wastes from four sewage treatment plants, and approximately 7.0 mgd of industrial wastes, and 222 mgd of cooling water from nine industrial plants. At the present time, the domestic sewage receives both primary and secondary treatment, and the industrial wastes are adequately controlled through various treatment methods. The completion of the Victoria Barge Canal will stimulate industrial and population growth in the area. This growth will require the expansion of a number of both municipal and industrial waste treatment plants in the area to protect fish propagation and recreation use.

Aransas Bay

From its immediate vicinity, Aransas Bay receives approximately 4.7 mgd of domestic wastes from 10 sewage treatment plants, and approximately 0.4 mgd of industrial wastes from 5 industrial plants. At present, the domestic sewage receives both primary and secondary treatment, while the industrial wastes are controlled by various treatment methods. The most pressing need in the Aransas Bay system is a greater degree of control of oilfield brines, and other oilfield wastes. A secondary need is the expansion of sewage treatment facilities to keep pace with growth.

Laguna Madre

From its immediate area, Laguna Madre receives approximately 1.4 mgd of domestic wastes from 3 sewage treatment plants, and approximately 1.2 mgd of industrial wastes from 11 industrial plants.

The domestic sewage receives oxidation pond treatment, and the industrial wastes are controlled by various treatment methods. A portion of the oxidation pond effluents from the cities is used for irrigation. However, as the area's population and economy grow, it is anticipated that the treatment facilities of the cities will need improvement to treat adequately that waste water not utilized in irrigation.

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